

**Pediatric Asthma and  
Health Services Utilization  
in TennCare:  
A Retrospective Analysis**

Bureau of TennCare  
Department of Finance and Administration  
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## **Pediatric Asthma and Health Services Utilization in TennCare: A Retrospective Analysis**

“Asthma is a chronic disorder of the airways that causes recurrent and distressing episodes of wheezing, breathlessness, chest tightness, and nighttime or early morning coughing (1).” It is a condition that is highly prevalent in the United States especially in children under the age of twenty-one. The overall prevalence of asthma in 1996 was 55.2 cases per 1,000 population, while the prevalence among children under the age of 18 was 62.0 (2). This translates to 14 million individuals overall and 4 million children. Asthma is the most common chronic condition among children (3). The prevalence of pediatric asthma has been on the rise in the United States. In 1982, approximately four percent of children eighteen or younger had asthma, while in 1994 it was approximately seven percent (1). This upward trend is evident even when the data is broken down by race.

Within the TennCare population, pediatric asthma is much more prevalent than in the general population. The prevalence rate in 1997 was 103.4 per 1,000 and in 1998, it was 112 per 1,000 (unpublished data). These rates are nearly double the rates for the general population.

Mortality due to asthma has also been increasing significantly over the last several years. Death rates due to asthma among individuals 5 to 34 years of age have nearly tripled from 1979 to 1995 (1). In 1997, there were 5,434 deaths due to asthma in the United States and 235 of them were children under the age of twenty (4). Likewise in the State of Tennessee, there were 97 deaths with nine of them children.

Asthma is considered an ambulatory care sensitive condition (5, 6). This means that hospitalizations for this disease can be minimized if the patient receives proper ambulatory care in a doctor’s office or an outpatient clinic. As such the number of hospitalizations is a good indicator of the quality of ambulatory care an individual is receiving. Likewise, emergency room (ER) visits are a good indication of quality of care among asthmatics. If the patient receives good ambulatory care, then visits to the emergency room should be minimized.

Ironically, the level of physician office visits is also a good measure of quality in this case. Not all urgent or emergent medical problems are treated in the hospital emergency room. Sometimes these emergency conditions are treated in the doctor’s office. As a result, a decrease in ambulatory care visits would suggest an improvement in the quality of care for asthmatics.

A previous report (7) produced in 1997 showed a decrease in both inpatient admissions and ER visits for asthma from 1993 (the last year of Medicaid) to 1996. This report concluded that hospitalizations and ER visits due to asthma decreased among the TennCare population due to the ambulatory care received from primary care physicians. However, the 1997 report presented rates per total member-years rather than only the experience of enrollees suffering from asthma. This current report builds on the earlier one by examining rates of hospitalizations, ER visits, and ambulatory care visits for a cohort of

individuals. This cohort was continuously enrolled in both 1997 and 1998 and had previously been diagnosed with asthma. In this way, a more accurate picture of the quality of care given to asthmatics under the TennCare program can be determined.

## METHODOLOGY

The basic design of this study is a retrospective cohort design. Using encounter (claims) data, two cohorts of individuals, one for a cross-sectional analysis and the second for a longitudinal analysis, were created. These cohorts consisted of both individuals who had an asthma diagnosis and individuals without an asthma diagnosis matched to them. Outcome measures were then analyzed for each of these groups. The details of this methodology follow.

### Data

The data for this study were encounter or claims data. Prior to the implementation of TennCare in 1994, all claims for payment from Medicaid were processed by the state. As a result, a large database of information from the claims was created. That database was used to calculate rates and proportions for the 1992/93 measures shown in this report.

With the implementation of TennCare, the various managed care organizations (MCO) are responsible for claims processing. These MCOs process the claims and then forward to the state, on a monthly basis, a record of each claim or encounter processed, which are entered into another large database. These records contain many of the data elements needed to produce the outcome measures for this study. The 1994/95 and 1997/98 measures came from this database.

### Formation of the Cross-Sectional Cohort

Cohort selection began with the identification of any enrollee who had at least one claim in 1992 or 1993 with a diagnosis of asthma (ICD-9 code of 493.xx). The identified enrollees were then compared to the 1997 and 1998 TennCare enrollment files in order to identify those who were under the age of 21 in 1998 and who were continuously enrolled throughout 1997 and 1998. These enrollees formed the experimental group in the cross-sectional cohort. They were individuals who had been enrolled throughout 1997 and 1998 and thus, had ample opportunity to access services. They were also individuals who had been diagnosed with asthma at least as early as 1992 or 1993 and therefore, had lived with their chronic condition for a few years. Forming the experimental group in this way gave us the greatest opportunity for evaluating asthmatic children's use of services under the TennCare program.

A control group was then selected from the rest of the enrollees continuously enrolled in 1997 and 1998. This group was formed by randomly selecting from subsets of enrollees matched to the experimental group on the

basis of sex, race, and age. In this way, the control group was similar to the experimental except that they had never been diagnosed with asthma according to TennCare encounter data.

### Formation of the Longitudinal Cohort

To form the longitudinal cohort, individuals in the cross-sectional cohort were compared to the enrollment records for 1992/93 and 1994/95. All enrollees who were continuously enrolled in these two time periods were selected for the longitudinal cohort. Thus with the experimental group of the longitudinal cohort, we have individuals who were diagnosed with asthma at least in 1992/93 and who had ample opportunity to access services in each of three different time periods. The matched control group also had ample opportunity to access service in these three periods.

By following these individuals from their enrollment in Medicaid, into their enrollment in early TennCare, and finally their later enrollment in TennCare, we can evaluate the impact of TennCare on the treatment of children with asthma. With comparison to the control group, we can tell if any changes in asthmatic's use of services are specific to asthmatics or related to overall changes in the use of services by TennCare enrollees. The end result should be a thorough evaluation of the treatment of children with asthma in the TennCare program.

### Dependent Measures

Five measures were evaluated in this study – inpatient discharges, percent of enrollees with at least one emergency room (ER) visit, average number of ER visits, percent of enrollees with at least one ambulatory care visit, and average number of ambulatory care visits. Each measure was based on two years worth of data rather than the typical one year. Thus the percentage of enrollees with at least one emergency room visit represents visits within both 1997 and 1998 and not each year separately.

Further, in the longitudinal cohort each measure was calculated for all applicable claims and for claims with asthma as the primary diagnosis. In this way, we could evaluate all discharges, ER visits, and ambulatory care visits for children with asthma and discharges, ER visits, and ambulatory care visits that were specifically related to asthma attacks. Both sets of measures give an indication of the quality of healthcare for asthmatic children in TennCare.

## RESULTS

### Comparison of Experimental and Control Groups

There were 36,303 enrollees in the cross-sectional sample – 12,334 of them in the experimental group and 23,969 in the control group. Table 1 compares the two groups based on various demographic variables. There is very close agreement on sex, race, and age, which were the variables used in

matching. There is also good agreement on other demographic variables such as program category, managed care organization, and region of residence. It appears that the two groups are equivalent to each other except for the existence of asthma in the experimental group.

Table 1: Comparison of Experimental and Control Groups on Various Demographic Characteristics.

Comparison Demographic	Experimental Group Number	Control Group Number	Experimental Group Percentage	Control Group Percentage
<b>Sex</b>				
Male	7,378	14,370	59.8%	60.0%
Female	4,956	9,599	40.2%	40.0%
<b>Race</b>				
White	6,841	13,301	55.5%	55.5%
Black	5,217	10,145	42.3%	42.3%
Other	276	523	2.2%	2.2%
<b>Age</b>				
4	553	1,073	4.5%	4.5%
5	1,842	3,553	14.9%	14.8%
6	1,651	3,216	13.4%	13.4%
7	1,253	2,436	10.2%	10.2%
8	1,043	2,033	8.5%	8.5%
9	1,000	1,944	8.1%	8.1%
10	815	1,587	6.6%	6.6%
11	712	1,385	5.8%	5.8%
12	605	1,181	4.9%	4.9%
13	510	989	4.1%	4.1%
14	463	903	3.8%	3.8%
15	417	810	3.4%	3.4%
16	390	760	3.2%	3.2%
17	380	739	3.1%	3.1%
18	269	523	2.2%	2.2%
19	240	466	1.9%	1.9%
20	191	371	1.5%	1.5%

Table 1: Comparison of Experimental and Control Groups on Various Demographic Characteristics (Continued).

Comparison Demographic	Experimental Group Number	Control Group Number	Experimental Group Percentage	Control Group Percentage
<b>Program Category</b>				
Disabled Uninsurable	3	5	0.0%	0.0%
Disabled Uninsured	16	27	0.1%	0.1%
Disabled	1,190	2,800	9.7%	11.7%
Medicaid	9,716	17,727	78.8%	74.0%
Uninsured	1,315	3,204	10.7%	13.4%
Uninsurable	94	206	0.8%	0.9%
<b>Managed Care Organization</b>				
OmniCare	336	1,022	2.7%	4.3%
BlueCare	6,252	10,888	50.7%	45.5%
John Deere	160	265	1.3%	1.1%
T.L.C.	441	1,143	3.6%	4.8%
Xantus	1,383	2,595	11.2%	10.8%
Preferred Health	627	1,264	5.1%	5.3%
Prudential	69	209	0.6%	0.9%
Access MedPlus	2,890	6,328	23.4%	26.4%
Vanderbilt Health Plan	176	255	1.4%	1.1%
<b>Region of Residence</b>				
Northeast	1,010	1,736	8.2%	7.3%
East	1,606	2,983	13.1%	12.5%
Southeast	709	1,236	5.8%	5.2%
Upper Cumberland	447	1,181	3.6%	5.0%
Mid-Cumberland	1,084	1,853	8.8%	7.8%
South Central	591	1,170	4.8%	4.9%
Northwest	626	914	5.1%	3.8%
Southwest	865	1,732	7.0%	7.3%
Davidson County	1,277	2,355	10.4%	9.9%
Hamilton County	993	1,150	8.1%	4.8%
Knox County	761	1,210	6.2%	5.1%
Shelby County	2,311	6,283	18.8%	26.4%

## Cross-Sectional Results

### Inpatient Discharges

Figure 1 shows the rate per 1000 enrollees of inpatient discharges in 1997/98 for the experimental and control groups. Rates are shown overall and broken down by sex and race. The experimental group's rates are approximately double the rates for the control group. The highest rates are among those of other races, while the greatest difference between rates are among those of black race. Black asthmatic males, with a rate of 103.6 per 1000, are three and a half times as likely to be hospitalized as non-asthmatic black males. All differences shown are statistically significant with a probability of less than .0001.

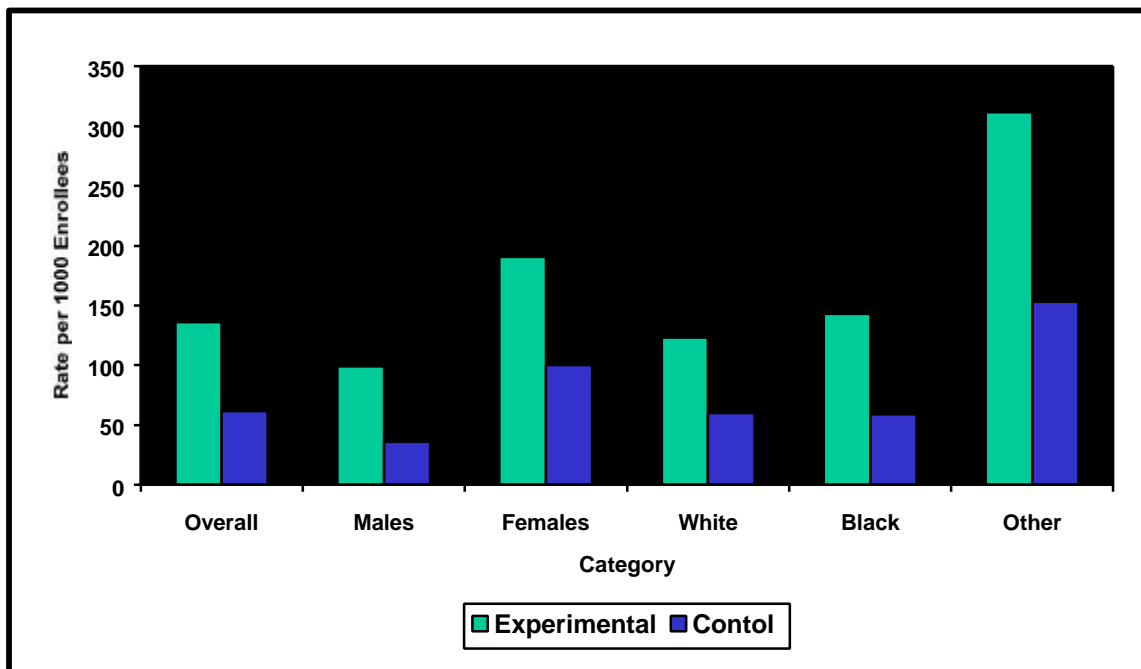


Figure 1: Rate per 1000 of Inpatient Discharges for the Cross-Sectional Cohort in 1997/98.

### Percentage of Enrollees Who Had at Least One ER Visit

Figure 2 gives the percentage of enrollees who visited the emergency room at least once in 1997/98 broken down by sex and race. The percentages for asthmatics are consistently higher than for non-asthmatics. The overall percentage for enrollees with asthma is 53.7 percent, approximately 1.4 times the percentage for the control group. The other categories have similar ratios. All differences are statistically significant to the less than .001 level except the percentages for other race that are significant to the 0.025 level.

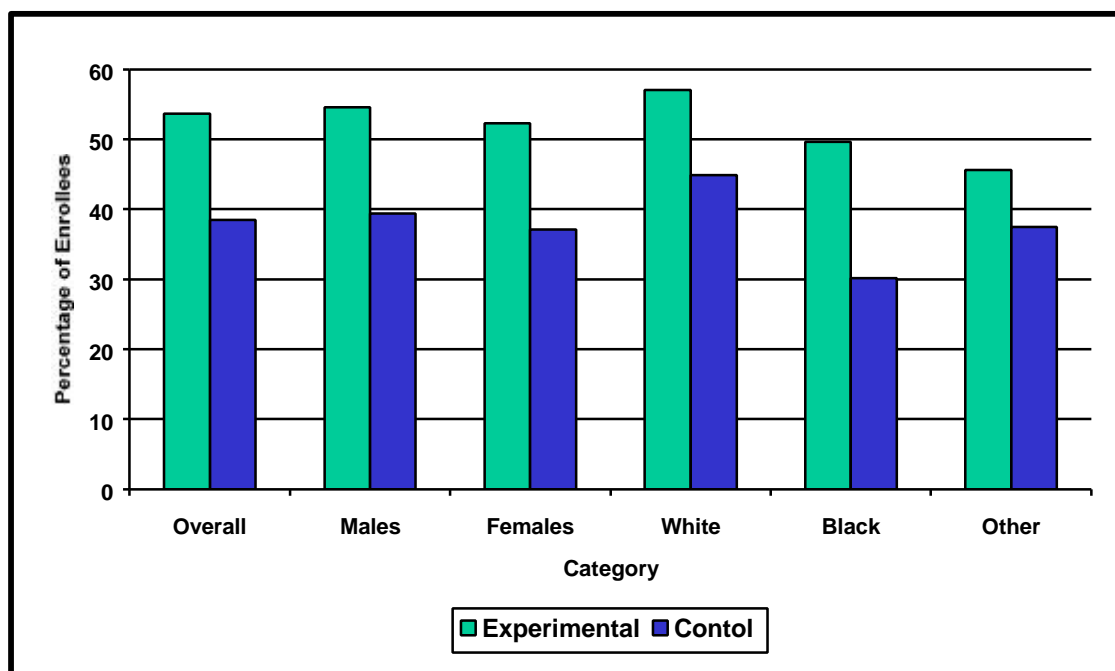


Figure 2: Percentage of Enrollees from the Cross-Sectional Cohort Who Visited the Emergency Room at Least Once in 1997/98.

#### Average Number of ER Visits

The average number of emergency room visits by asthmatics and non-asthmatics in 1997/98 is shown in Figure 3. This figure gives the mean number of visits overall, by sex, and by race. Overall, asthmatics had an average of 1.32 ER visits per enrollee, which is approximately double the number for non-asthmatics at 0.73. Asthmatics in all categories had higher average visits than non-asthmatics, with females and those of the white race having the highest. All differences shown on the figure are statistically significant to the .0001 level.

#### Percentage of Enrollees with at Least One Ambulatory Care Visit

Figure 4 displays the percentage of enrollees who had at least one ambulatory care visit by overall, sex, and race. This figure reveals that a somewhat higher percentage of children with asthma in all categories had at least one visit. Overall, 82.8 percent of children with asthma had at least one visit compared to 68.8 percent of other children. Similar percentages can be seen when the data are reported by sex or race. All reported differences are statistically significant to the .001 level.



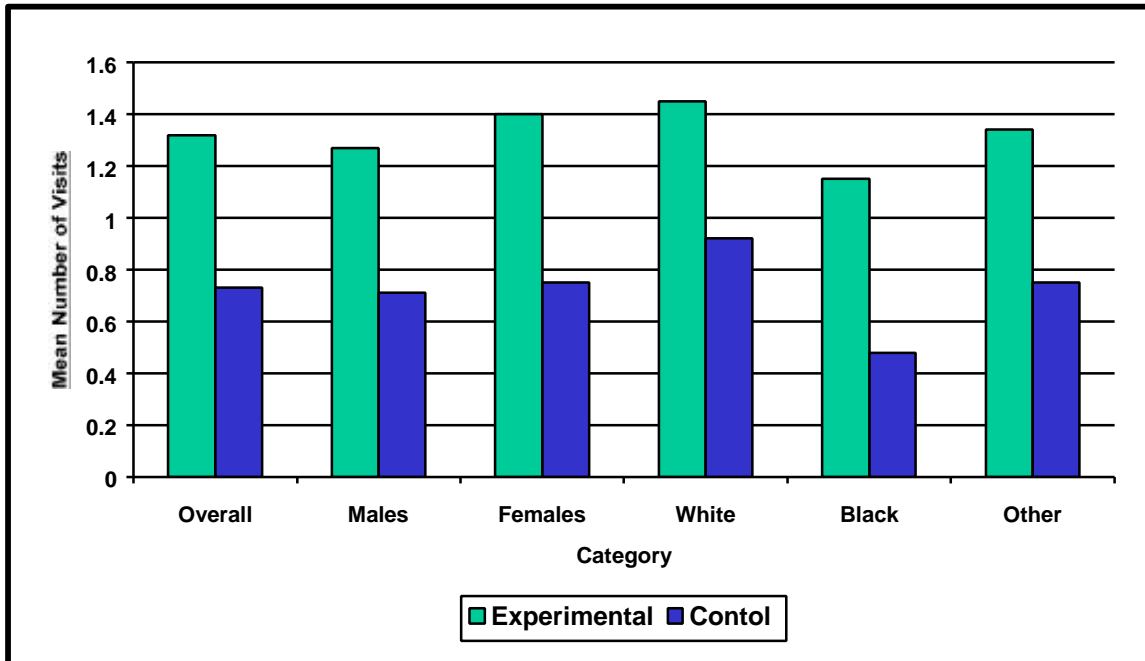


Figure 3: Mean Number of Emergency Room Visits in the Cross-Sectional Cohort in 1997/98.

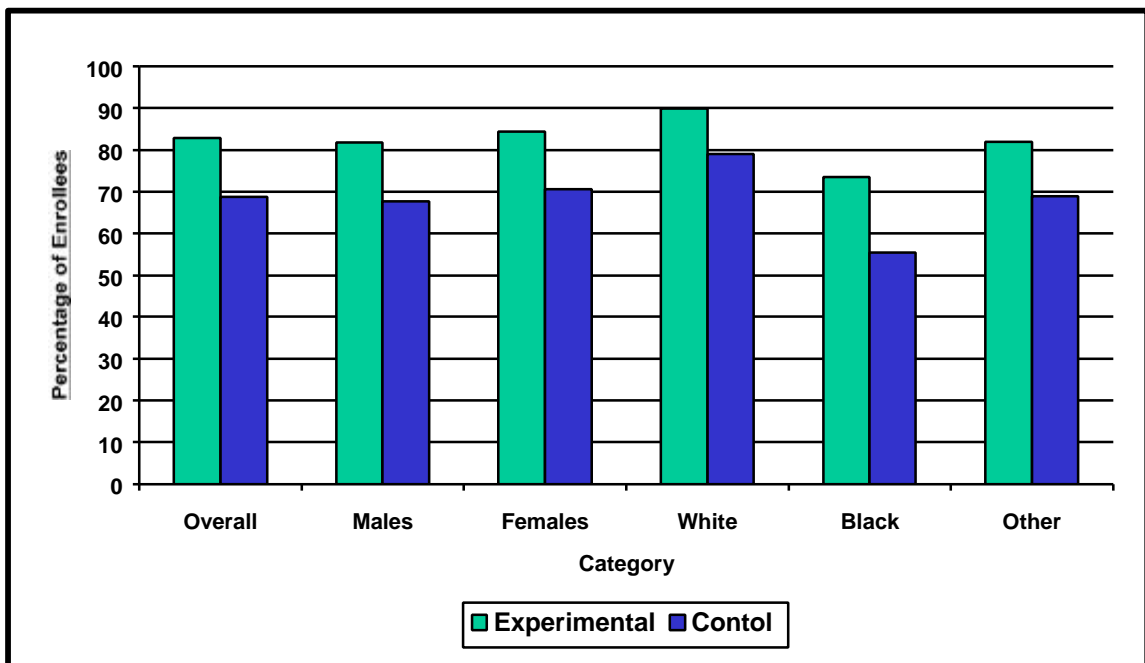


Figure 4: Percentage of Enrollees from the Cross-Sectional Cohort Who Had at Least One Ambulatory Care Visit in 1997/98.

### Mean Number of Ambulatory Care Visits

The average number of visits by asthmatics and non-asthmatics in the cross-sectional cohort for 1997/98 is shown in Figure 5. As was the case with emergency room visits, this figure reveals that children with asthma had a higher mean number of visits than children without asthma. The highest numbers were again with those of white race and those who were female. All differences were statistically significant to the .0001 level.

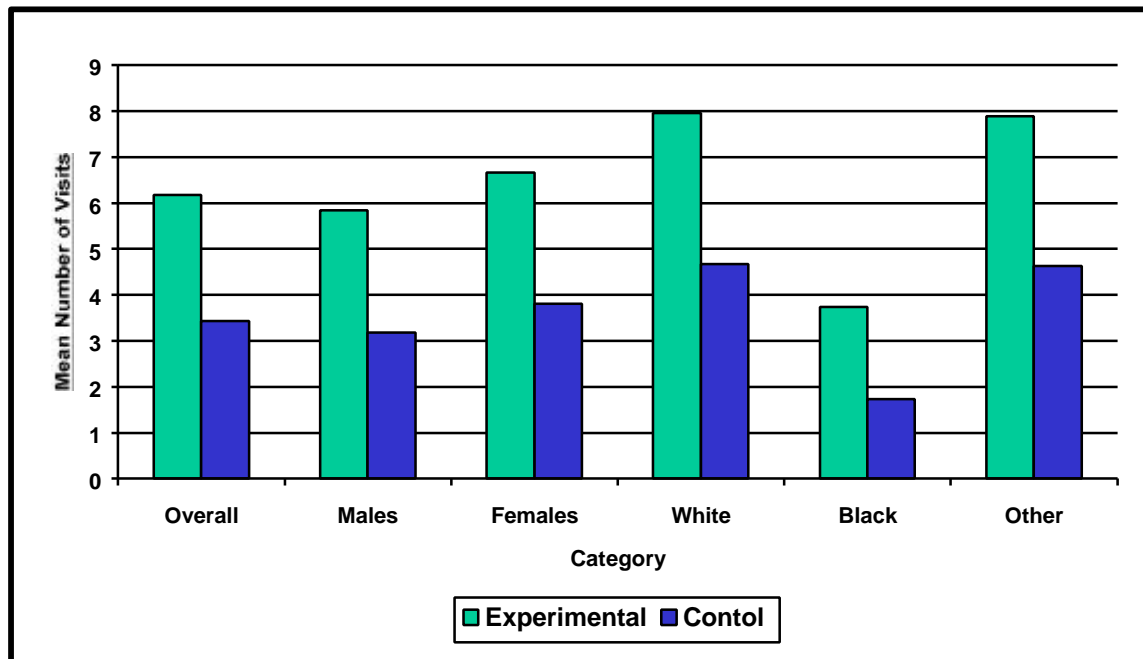


Figure 5: Mean Number of Ambulatory Care Visits in the Cross-Sectional Cohort in 1997/98.

### Summary of Cross-Sectional Cohort Findings

Throughout the cross-sectional cohort the asthmatic group had higher utilization than the non-asthmatic group regardless of the measure used. In most cases, the group of children with asthma had one and a half to two and a half times the utilization of the non-asthmatic children. Also, the heaviest utilization of services tended to be among those who were female and those of white race. These findings are not surprising given the greater needs generally associated with those enrollees who suffer from asthma.

## Longitudinal Results

### Inpatient Discharges

#### All Diagnoses

The rate per 1000 enrollees of inpatient discharges with all diagnoses over time for the longitudinal sample is shown in Figure 6. There was a large decrease in hospitalizations among those children who suffered from asthma after the implementation of TennCare. The experimental group ( $n = 6207$ ) dropped from a rate of 542.5 per 1000 in 1992/93 to a rate of 167.9 per 1000 in 1997/98 ( $p < .0001$ ). In contrast, the control group ( $n = 10,151$ ) dropped from a rate of 97.3 per 1000 to 67.8 per 1000 ( $p < .0001$ ). While both groups had statistically significant decreases in rates, the decrease among asthmatics was far greater than the decrease among the control group.

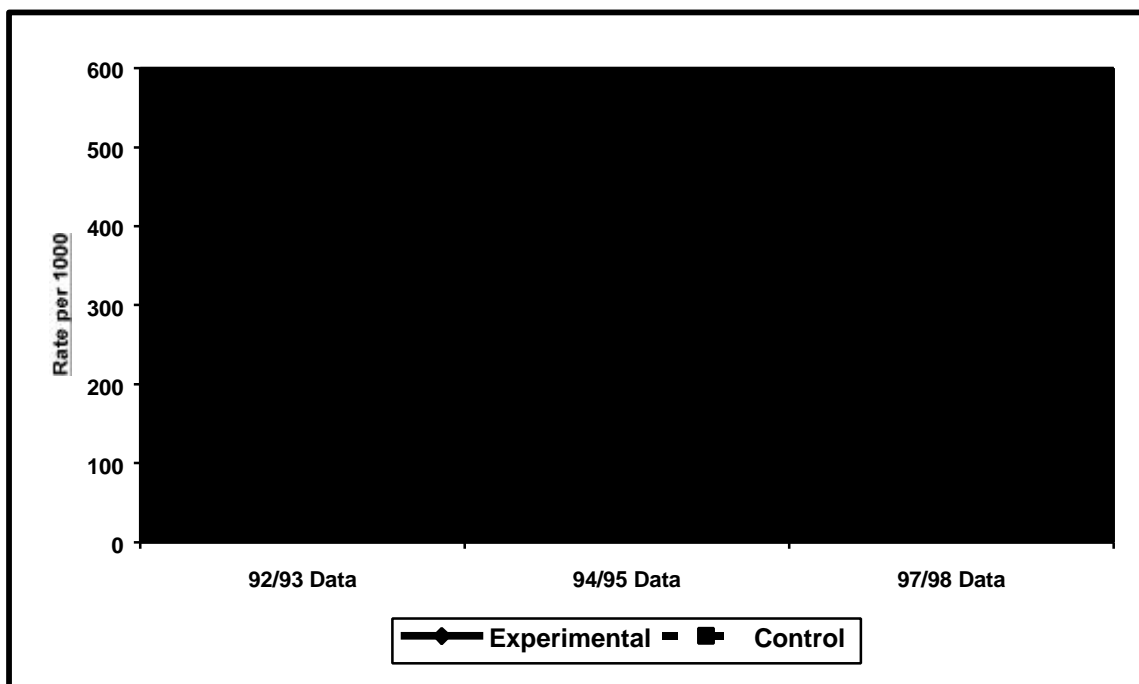


Figure 6: Rate per 1000 of Inpatient Discharges (All Diagnoses) for the Longitudinal Sample from 1992/93 to 1997/98.

#### Asthma Diagnoses

Figure 7 shows the rate per 1000 enrollees of inpatient discharges with a primary diagnosis of asthma for the experimental group of the longitudinal sample. This figure reveals the same sharp decline as was evident for this group in Figure 6. The rate declined from 202.2 per 1000 in 1992/93 to 42.7 per 1000 in 1997/98 ( $p < .0001$ ). Clearly, asthma attacks requiring hospitalization decreased significantly after the implementation of TennCare.

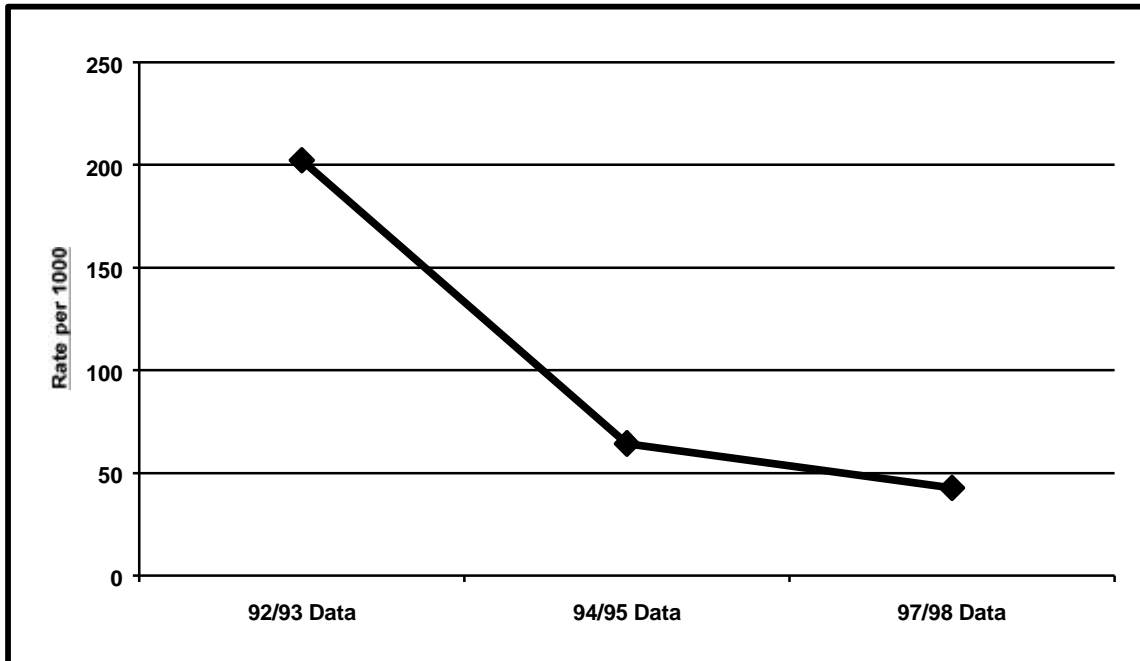


Figure 7: Rate per 1000 of Inpatient Discharges with an Asthma Diagnosis for the Experimental Group of the Longitudinal Sample from 1992/93 to 1997/98.

#### Percentage of Enrollees Who Had at Least One ER Visit

##### All Diagnoses

The percentage of enrollees who had at least one emergency room visit with any diagnosis is shown in Figure 8. This figure reveals that the percentages for both the experimental and control groups have decreased significantly since 1992/93. The experimental group has decreased from 84.2 percent in 1992/93 to 54.6 percent in 1997/98 ( $p < .0001$ ), and the control group has decreased from 54.3 percent to 37.8 percent ( $p < .0001$ ). This is approximately 30 points for the experimental group, while the control group has decreased about half as much.

##### Asthma Diagnoses

The results are similar when only visits with asthma diagnoses are examined. These data are shown in Figure 9. The percentage of enrollees who had at least one visit to the ER due to an asthma attack decreased from 34 percent in 1992/93 to 11.8 percent in 1997/98 ( $p < .0001$ ). This is a decrease of 22 points over the time period involved. Trips to the emergency room for asthma attacks have decreased significantly since the implementation of TennCare.

#### Average Number of ER Visits

##### All Diagnoses

Figure 10 gives the average number of ER visits for the longitudinal sample from 1992/93 to 1997/98. This figure shows decreases similar to

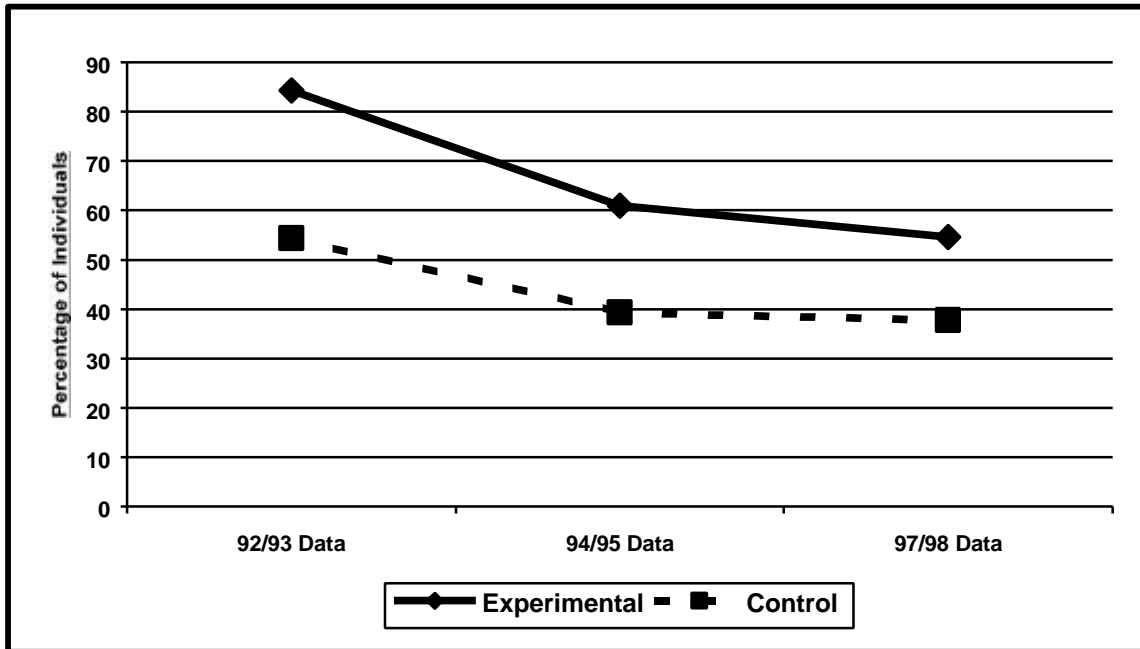


Figure 8: Percentage of Enrollees in the Longitudinal Sample Who Had at Least One Emergency Room Visit with Any Diagnosis from 1992/93 to 1997/98.

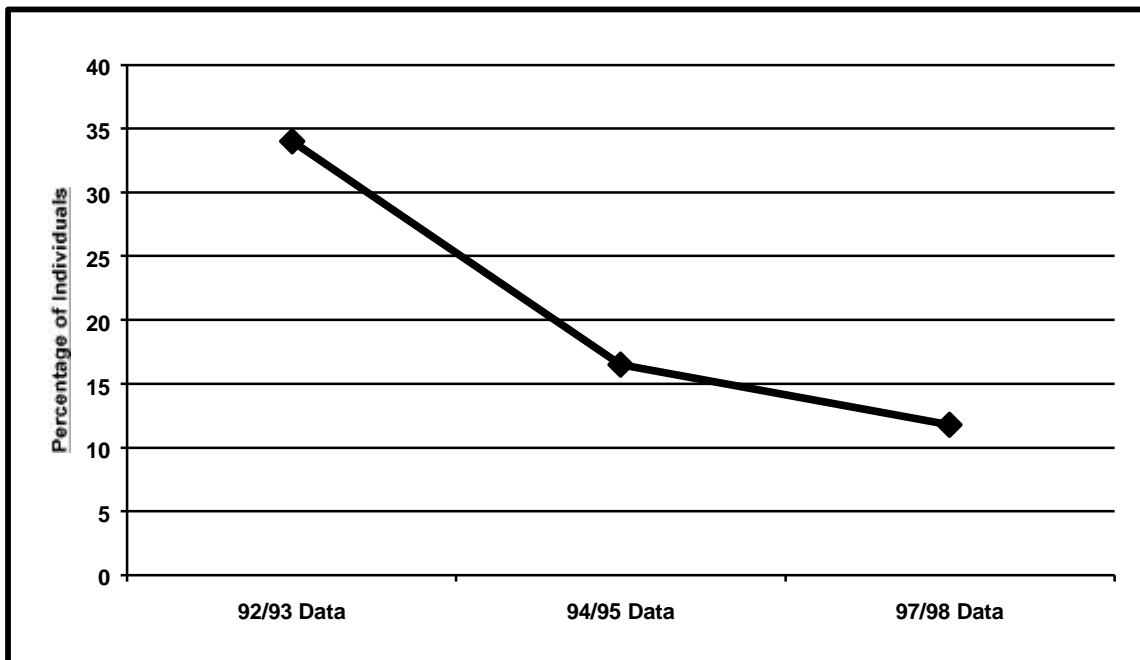


Figure 9: Percentage of the Experimental Group from the Longitudinal Sample Who Had at Least One ER Visit with an Asthma Diagnosis from 1992/93 to 1997/98.

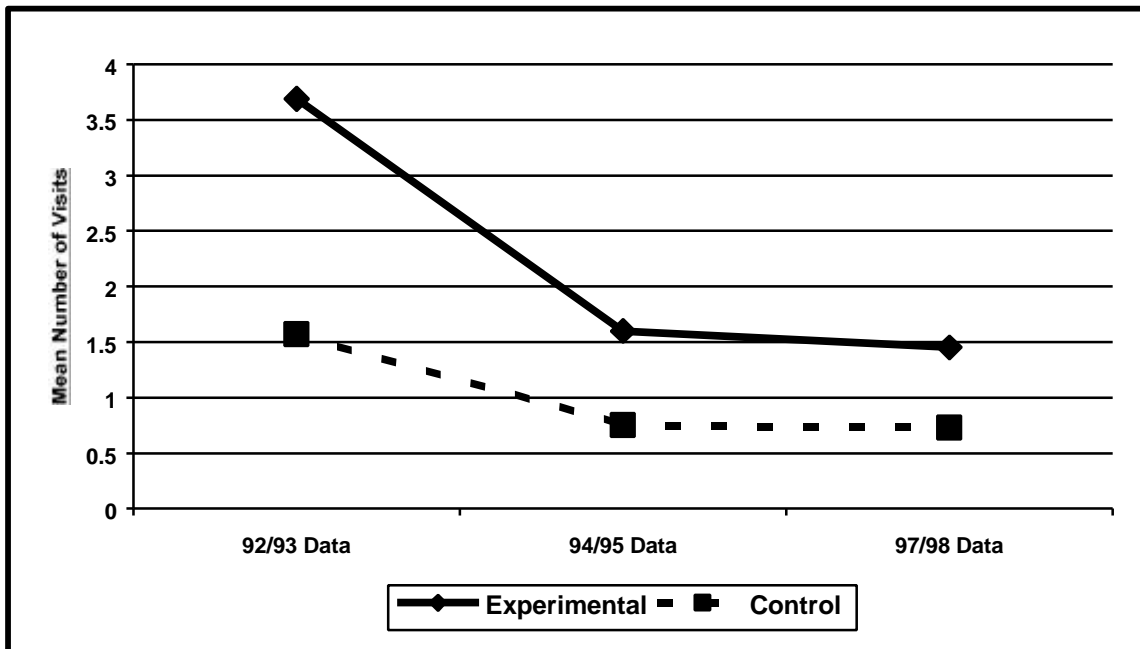


Figure 10: Mean Number of Emergency Room Visits With Any Diagnosis for the Longitudinal Sample from 1992/93 to 1997/98.

Figure 8. The experimental group went from a mean of 3.69 visits in 1992/93 to a mean of 1.45 visits in 1997/98 ( $p < .0001$ ), which is a decrease of 60 percent. The control group showed a slightly lower decrease of 54 percent going from a mean of 1.57 visits in 1992/93 to 0.73 visits in 1997/98 ( $p < .0001$ ). Both groups showed similar declines with the experimental group only slightly greater.

#### Asthma Diagnoses

The average number of ER visits for which asthma is the primary diagnosis is shown in Figure 11. This figure reveals a pattern very similar to the experimental group pattern in Figure 10. The mean number of ER visits with asthma as the primary diagnosis went from 0.61 in 1992/93 to 0.20 in 1997/98 ( $p < .0001$ ), a decrease of 67 percent. As was the case with discharges and percentage of enrollees who had at least one ER visit, far fewer visits were the result of asthma attacks after the implementation of TennCare.

#### Percentage of Enrollees with at Least One Ambulatory Care Visit

##### All Diagnoses

The percentage of enrollees who had at least one ambulatory care visit either in a physician's office or hospital outpatient clinic dropped for the experimental group, but increased for the control group. As shown in Figure 12, the experimental group went from 89.04 percent in 1992/93 to 82.17 percent in 1997/98 ( $p < .0001$ ). This is approximately a seven point decrease. The control group increased over the same time period from 63.69 percent to 65.27 percent. Statistical testing showed that this change was not statistically significant. Neither change is a significant practical difference.

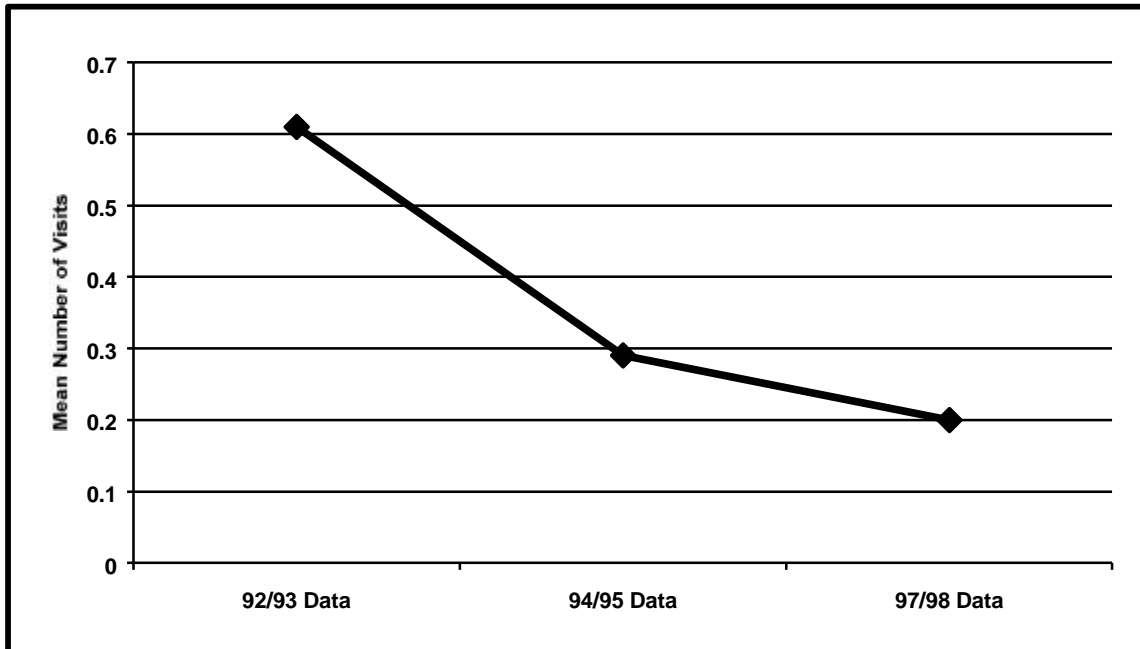


Figure 11: Mean Number of Emergency Room Visits by the Experimental Group For Which Asthma is the Primary Diagnosis from 1992/93 to 1997/98.

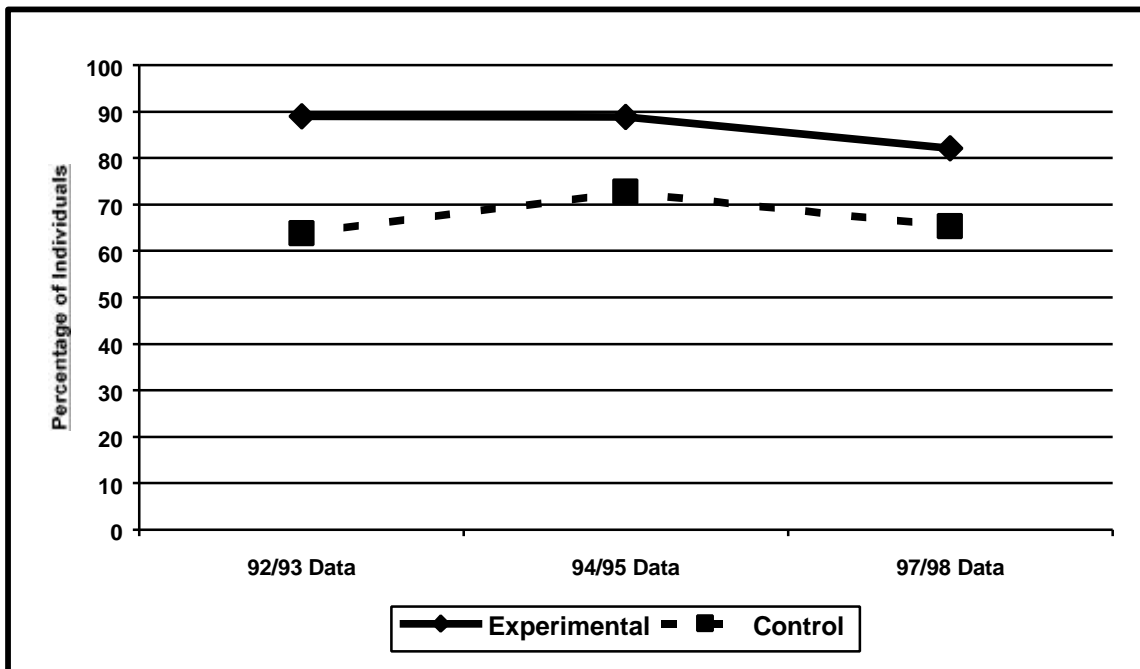


Figure 12: Percentage of Individuals From the Longitudinal Sample Who Had at Least One Ambulatory Care Visit with Any Diagnosis from 1992/93 to 1997/98.

### Asthma Diagnoses

Very different results are obtained when we limit the analysis to visits with an asthma primary diagnosis. Figure 13 contains those results. The percentage of enrollees who had at least one ambulatory care visit under these circumstances declined from 57 percent in 1992/93 to 26.3 percent in 1997/98 ( $p < .0001$ ). This is approximately a 30 point drop over the time period. Far fewer enrollees had at least one ambulatory care visit due to asthma in 1997/98 than was the case in 1992/93.

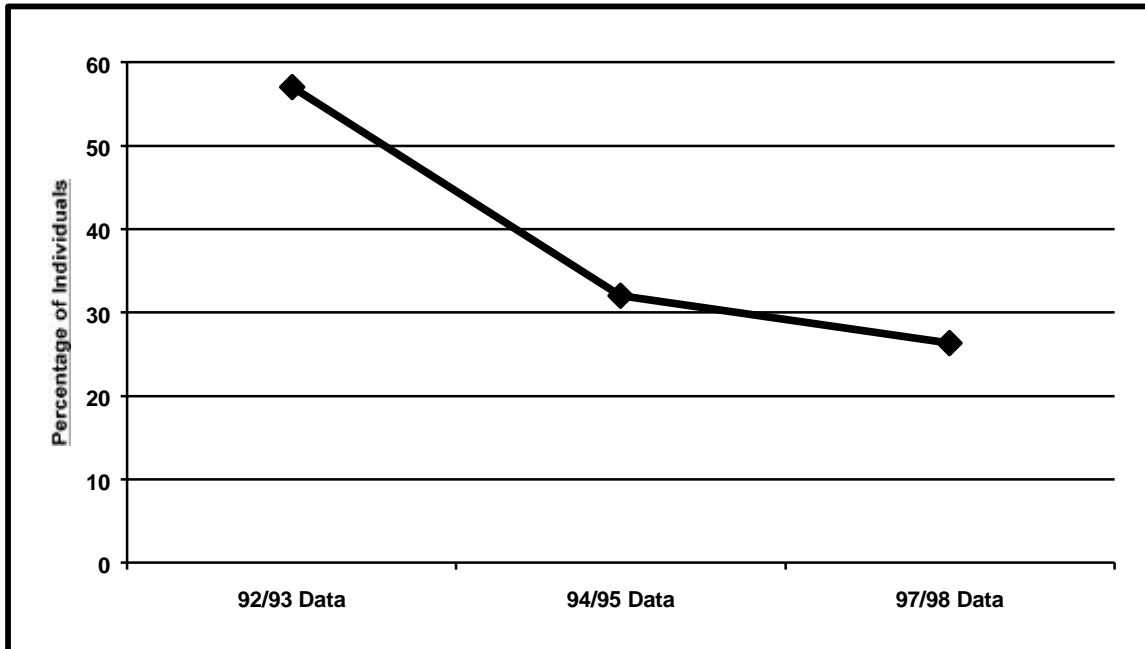


Figure 13: Percentage of Enrollees in the Experimental Group Who Had at Least One Ambulatory Care Visit with Asthma as the Primary Diagnosis from 1992/93 to 1997/98.

### Average Number of Ambulatory Care Visits

#### All Diagnoses

Figure 14 shows the mean number of ambulatory care visits for the longitudinal sample from 1992/93 to 1997/98. The mean for the experimental group went from 10.95 visits in 1992/93 to 6.29 visits in 1997/98 ( $p < .0001$ ), while the control group went from 4.34 visits in 1992/93 to 3.11 visits in 1997/98. The decline for the experimental group was approximately 43 percent compared to the control group's decline of approximately 28 percent.

#### Asthma Diagnoses

Very similar results were obtained when the analysis was limited to visits for asthma as shown in Figure 15. The mean number of visits for which asthma is the primary diagnosis declined by 51 percent from 1.47 in 1992/93 to 0.72 in 1997/98. This is slightly higher than the results shown in Figure 14.



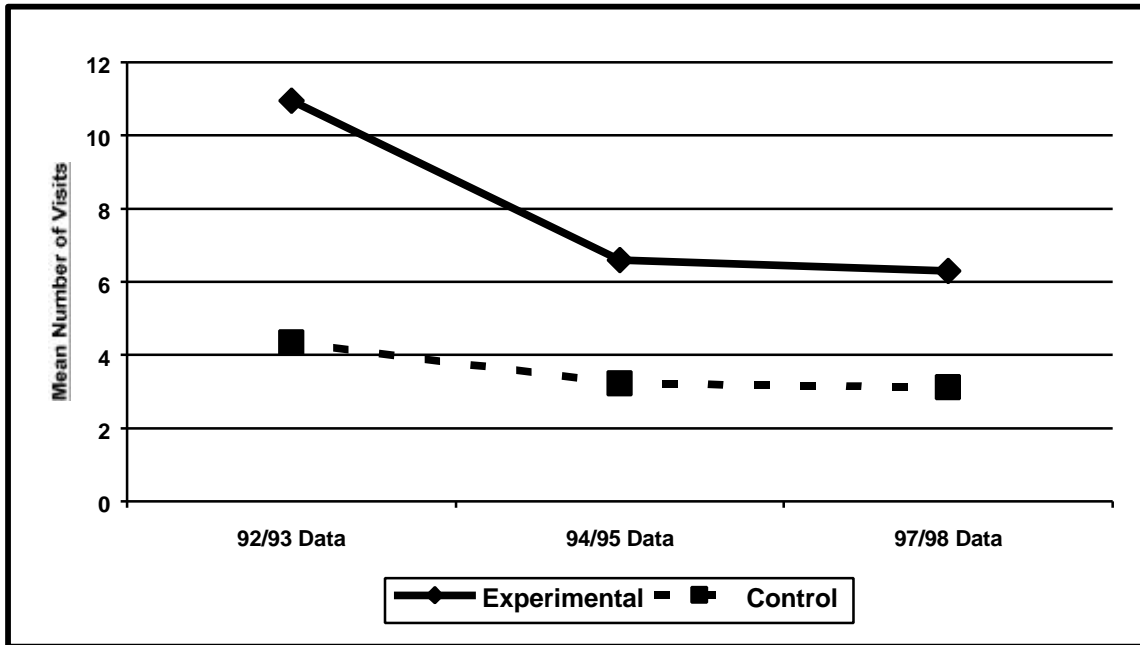


Figure 14: Mean Number of Ambulatory Care Visits with Any diagnosis for the Longitudinal Sample from 1992/93 to 1997/98.

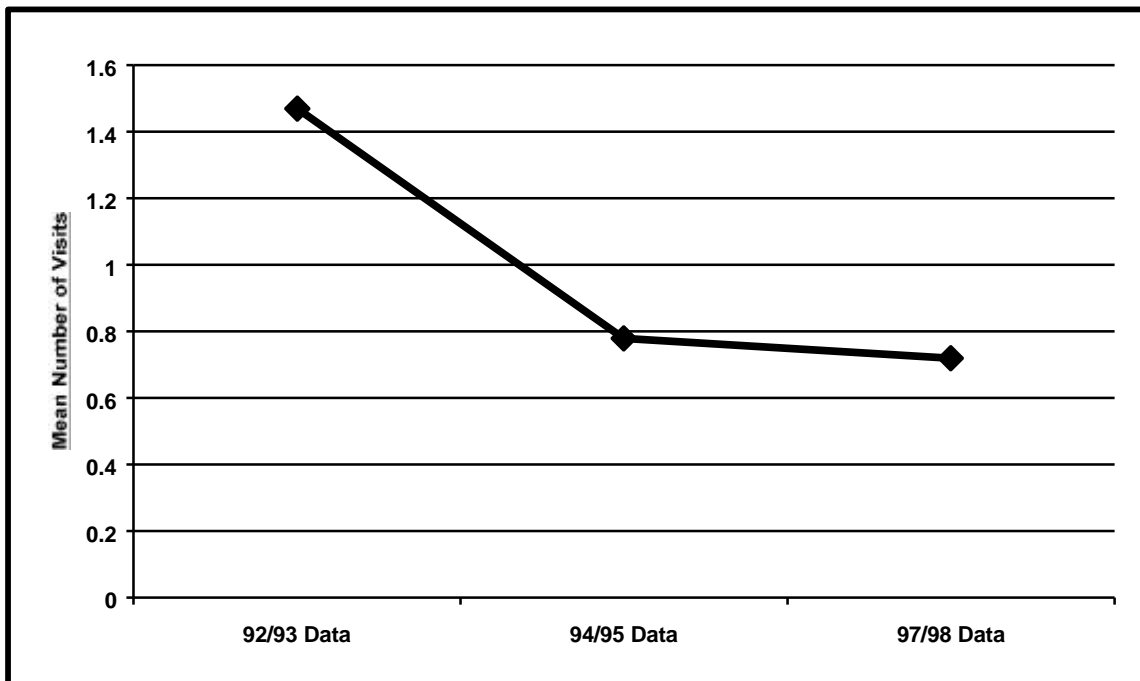


Figure 15: Mean Number of Ambulatory Care Visits for the Experimental Group For Which Asthma is the Primary Diagnosis from 1992/93 to 1997/98.

### Summary of Longitudinal Cohort Findings

The experimental group demonstrated declines on all measures, while the control group showed declines on all measures but ambulatory care visits. The declines for the experimental group were of a higher magnitude in all cases. The declines when the data were restricted to only claims for which asthma was the primary diagnosis had even higher magnitudes. It appears that after the implementation of TennCare, asthmatics had fewer hospitalizations, less visits to the emergency room, and fewer ambulatory care visits, and this reduction was of a higher magnitude than the control group.

### Alternative Explanations

Two alternative explanations might be invoked to explain the differences shown in this study. One explanation relates to the exclusion of denied claims and the other to maturity effects. A discussion of these two alternative explanations follows.

Since the data used in this study consisted of only paid claims, it is possible that the results do not reflect a decrease in actual discharges or visits, but rather an increase in denial rates by the managed care organizations. As the MCOs are required to send both paid and denied claims to the Bureau of TennCare, this alternative explanation is easily examined. Denied claims for these cohorts were extracted from the TennCare database. The denied claims were then unduplicated so that if a claim was ever paid, it was not listed as having been denied. The denied claims that were never paid were then compared to the paid claims to determine if they could have effected the results. Within this sample eight percent of ambulatory care visits and nine percent of emergency room visits were never paid. These percentages are too small to effect the results.

Another possible explanation is maturity effects. Because a longitudinal sample was used, the average age of the group was getting older over the time period involved. If older children tend to have fewer hospitalizations or visits then this change in average age could be the cause of the findings above. To examine this explanation, the cross-sectional cohort was divided by age, and the utilization of the two groups compared. In the case of discharges and ER visits, older children tend to have higher rates than younger children. In the case of ambulatory care visits, it depends on where the age group is split. If it is split at 7 years of age, there is no difference in the number of visits, but if it is split at 10 years of age, older children tend to have more ambulatory care visits. Maturity effects could not have influenced the results reported above.

### DISCUSSION

On all measures included in this study, asthmatics had higher utilization than non-asthmatics in 1997/98. When examined over time, however, the utilization of children with asthma has decreased significantly with the implementation of TennCare. This is especially true when the utilization is limited

to those claims or encounters that had asthma as the primary diagnosis. It appears that the treatment of asthma under TennCare is greatly improved over the treatment under Medicaid.

These results may well be due to better preventive and primary care under the TennCare program. Asthma can be controlled by preventive methods including elimination of triggers and effective use of medications (3). All of this requires extensive education of patients by their physicians. The decreased utilization shown in this report suggests that TennCare providers are doing a better job of informing and motivating asthmatics than had been the case under Medicaid.

There are two caveats with this study. First the data used were encounter or claims data, and the results may be biased based on inaccuracies in that data. Secondly, children with asthma were identified by a claim that had asthma as a diagnosis. It is possible that some asthmatics did not have any claims with asthma during the study period and would not be identified by the methods used here. They would, therefore, end up in the non-asthmatic group and bias that group's results.

It appears that children in the TennCare program who suffer from asthma are receiving better care under TennCare than they did under Medicaid. While these children utilize the system about twice as much as children without asthma, their utilization has decreased significantly since the implementation of TennCare. The data presented here suggests that under the TennCare program, asthmatic children are receiving better primary and preventive care that is resulting in better management of this chronic condition and, ultimately, lower utilization of high cost and preventable health care services.

This report was prepared by Raymond H. Phillippi, Ph.D., Biostatistician in the Department of Quality Oversight of the Bureau of TennCare.

For questions, comments, and additional information regarding studies and research work at the Bureau, please contact Ken Okolo, FACHE, Director of Quality Oversight of the Bureau of TennCare at [kokolo@mail.state.tn.us](mailto:kokolo@mail.state.tn.us).

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